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NUCLEAR WEAPONS AND DELIVERY CAPABILITIES OF FREE WORLD COUNTRIES OTHER THAN THE US AND UK

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Submitted by the

DIRECTOR OF CENTRAL INTELLIGENCE

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NUCLEAR WEAPONS AND DELIVERY CAPABILITIES OF FREE WORLD COUNTRIES OTHER THAN THE US AND UK

THE PROBLEM

To estimate the capabilities and intentions of Free World countries other than the US and UK with respect to the development of an operational nuclear capability, i.e., both nuclear weapons and compatible delivery systems,[1] over the next decade.

(NOTE: In this paper we deal with the potential of certain individual Free World countries and certain groupings of them to develop an operational nuclear capability at present levels of external assistance, the likelihood of their initiating programs, and also the forms such programs might take. Any significant change in the level of external aid would clearly alter the basic estimates in regard to timing, likelihood, and form, contained herein.)

CONCLUSIONS

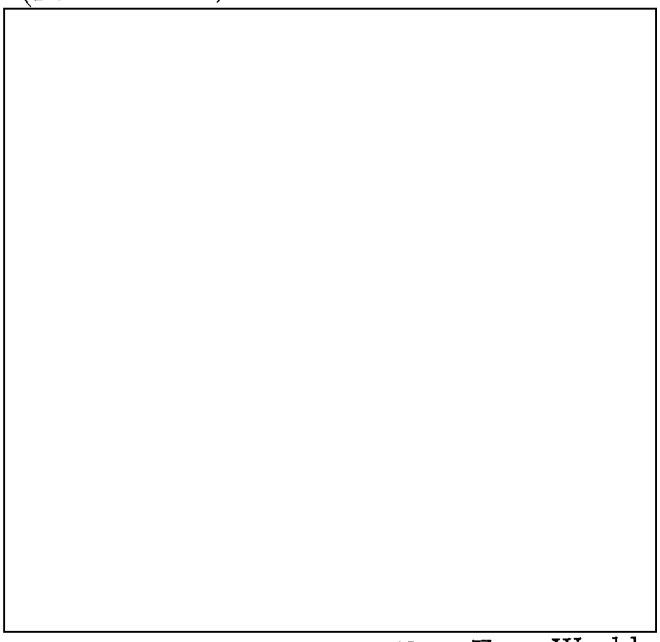
1. The prerequisites to developing a nuclear weapons program are becoming increasingly available to nonnuclear states. Uranium is easier to obtain; many countries are acquiring research and power reactors and are training technicians; information on weapons technology is more widespread. Nevertheless, the inhibitions on deciding to start a weapons program are formidable. At the present state of the art, the most limited weapons program would cost in the hundreds of million dollars and a moderate program of sophisticated weapons and delivery systems would run into the billions. We estimate that over the next several years there will be no technological breakthrough which would significantly alter the complexity and costs of these tasks. Furthermore, decisions on undertaking a nuclear weapons program remain profoundly influenced by psychological, political, and military considerations. (*Paras. 5–15*)

2. France, [redacted] have already made the decision to develop operational nuclear capabilities. Assuming no increase of outside aid, we estimate their program as follows:

a. France will almost certainly continue its program, and by 1962–1963, if it overcomes the difficulties shown in the 1961 tests, it will probably have an initial op-

[1] The words "operational nuclear capability" are used with this meaning throughout this paper.

erational nuclear capability using light bombers and compatible fission bombs. Provided France maintains a large-scale effort, by the end of the decade it could have a varied strike capability using aircraft, missiles with ranges up to 1,500–2,000 n.m. with either high-yield fission or thermonuclear warheads, and possibly nuclear-powered missile submarines. Loss of the Sahara testing sites could create major problems for the French. (*Paras. 20–22*)



3. We believe that no other Free World country has made the decision to start a nuclear weapons program. Among the countries which might do so in time to produce an operational nuclear capability before 1971 are Sweden and India.

a. Sweden is not likely to make a decision before 1963. If it then decided to pursue a weapons program, it could probably explode a device by 1965–1966, have a weapon deliverable by aircraft a year or so later, and fission warheads for domestically developed 500 n.m. missiles by the end of the decade. (*Paras. 29–31*)

b. If *India* decided within the next year or two to start a weapons program, it could have a modest capability, using aircraft and fission weapons, by 1968–1969. A decision by India to initiate a weapons program would probably be made only if the Communist Chinese first exploded a device, and if Communist Chinese foreign policy became more truculent. (*Paras. 32–35*)

4. We believe it unlikely that any other Free World country or possible grouping of countries will initiate weapons programs during the next several years. Even if they were to decide to do so, we believe that none except Canada could detonate a test device for at least 4–5 years after decision and could probably not, on their own, develop the types of weapons and delivery systems suitable to their needs before the end of this decade. (*Paras. 17–18, 36–44,* Table II, page 4.)

DISCUSSION

I. GENERAL CAPABILITIES

A. Nuclear Weapons Capabilities

5. The minimum requirements for the development and production of nuclear weapons include: (a) access to a supply of natural uranium; (b) the ability to separate weapon grade uranium 235 from natural uranium or to extract the plutonium produced in a reactor; and (c) the scientific and technical ability to design and fabricate the weapon. As indicated in Table I, these general requirements can, or could within the period of this estimate, be met by a number of countries. Moreover, as world uranium production and commercial sales of power reactors expand, it appears likely that, in absence of effective international controls, a country without domestic sources of natural uranium will be able to acquire it. It is also likely that any country will be able to obtain reactors which could be used for plutonium production, and could theoretically acquire the technical ability to produce at least a few crude weapons. While a number of countries supplying uranium to others impose restrictions on its use and ultimate disposition, sources which are willing to sell without restrictions are increasing, and some purchasers are reluctant to accede to limitations on use.

6. It is theoretically feasible for a country which has produced weapon grade fissionable materials to design and fabricate a nuclear weapon without testing. However, an untested weapon would be of uncertain reliability unless the producer had been supplied with the detailed design of a previously tested weapon. Hence we believe it highly unlikely that any country would manufacture and stockpile weapons of original design without first having conducted tests. The finding of suitable test sites would be a very difficult problem for most of these countries. While countries could theoretically conduct nuclear tests underground, such testing would involve a significant increase in costs, considerable time delays, and reduced diagnostic returns.

7. Between the decision of a country to undertake a nuclear weapons program and the time when the first crude weapons are produced, a considerable time would elapse. This would

TABLE I

SELECTED INDICATORS OF NUCLEAR WEAPON PRODUCTION CAPABILITY

XXX—Major
XX—Moderate
X—Small
P—Potential

COUNTRY	Domestic Availability of Uranium[a]	Nuclear Research Program	Nuclear Power Program	Industrial Resources Capacity
France	XXX	XXX	XXX	XXX
West Germany	X	XXX	X	XXX
Italy	X	XX	XX	XX
Belgium	—	XX	X	XX
Netherlands	—	XX	P	X
Norway	—	XX	X	X
Canada	XXX	XXX	XX	XXX
Sweden	XX	XXX	XX	XX
Switzerland	—	X	P	XX
Japan	X	XX	X	XX
India	XX	XX	X	XX
UAR	P	P	P	X
Australia	XX	X	P	XX

[a] This is a factor of diminishing importance because of the increasing ease with which nations can purchase uranium ore either with or without restrictions on its use or disposition.

[b] See paragraphs 23–24 of text.

be true even in the case of a grouping of countries having a joint nuclear research and power program. This time would vary from a few years to a decade depending upon a country's level of nuclear technology, its general industrial and scientific potential, the availability of testing sites and type of testing pursued, as well as the importance and urgency it might attach to the acquisition of such weapons. In most cases, the bulk of this time would probably be needed to construct and operate the main installations for obtaining weapon grade materials, either plutonium from a reactor or U–235 from an isotope separation plant.

8. As the number of power and research nuclear reactors in a country increases, the potential for producing plutonium will increase, which could reduce the time between decision and the availability of nuclear weapons. However, it is highly unlikely that countries which have not already initiated plutonium production programs could accumulate significant amounts of weapon grade materials in the next several years, given the present restrictions on the use of purchased uranium in many cases, and even more importantly, the absence of plutonium separation plants.

9. Furthermore, the steps between producing a first crude weapon and developing more sophisticated weapons are long and costly. If more than a token capability is aimed at, major isotope separation facilities for the production of weapon grade U–235 would be almost a necessity in view of the disproportionate cost of producing large quantities of plutonium. Advanced weapons development would require extensive testing. Moreover, in the case of a country with a small capacity to produce weapon grade material, testing would consume material which would otherwise be available for weapons production.

10. Assuming that there is a major effort to develop an operational nuclear capability, that outside aid continues at roughly what we believe to be current levels, and that present safeguard measures placed upon both materials and reactors remain effective for the next several years, Table II below indicates the probable time periods that various countries would require to explode a first nuclear device. Actual years are given for France which has already tested, [redacted] For the other countries, the time periods estimated are based upon the assumption that the programs will be initiated sometime in the next year or two.

11. These dates and time periods are also based on our estimate that there will be no significant technological breakthrough in the next several years which would significantly alter the complexity or economic costs of developing a nuclear capability. An example of such a possible technological development would be the perfecting of the gas centrifuge process for isotope separation. Compared to present separation methods, this process would require less electric power, be adaptable to small capacity production, and be more easily concealed. An advance of this kind would increase the number of countries which could afford to produce weapons, but would probably not advance the dates suggested in Table II.

TABLE II

ESTIMATED TIME REQUIRED FOR SELECTED COUNTRIES TO PRODUCE A FIRST NUCLEAR DEVICE

COUNTRY	FIRST DEVICE [a]
France	4 tested (1960–1961)
[redacted]	
Canada	1–2 years after decision
Sweden	3–4 years after decision
West Germany	4–5 years after decision
Italy	5–6 years after decision
India	5–6 years after decision
Japan	5–6 years after decision
UAR	[b]

[a] In most cases, a first crude weapon deliverable by aircraft, weighing some 5,000–10,000 pounds [redacted] could be produced in about a year after the first test device if sufficient materials were at hand. In the case of programs which were aimed at a specific sophisticated delivery system (e.g., the French program with its MIRAGE IV bomber—see paragraph 20), the production of more refined weapons would take longer.

[b] [redacted] The UAR, however, is so deficient in all the requirements for a nuclear weapons program that it would have to receive substantial assistance in all elements of the program. It could not, on its own, develop a nuclear capability during the period of this estimate.

B. Delivery Capabilities

12. An operational nuclear capability requires not only nuclear weapons, but also the ability to deliver these weapons with a reasonable degree of accuracy against potential targets. The specific delivery requirements of individual countries vary considerably, being determined in large part by a country's geographic position and the defensive capabilities of the potential enemy.

On the other hand, most of the European nations and Canada would require sophisticated and long-range systems to give them a capability against the nearest major Soviet targets.

13. The abilities of the various countries to develop a suitable delivery system, and the probable time required to do so, also vary considerably. All the countries listed in Table I probably could produce or acquire some aircraft delivery capability by the time their first generation of nuclear weapons became available. However, only a few of these countries will be able during the next 10 years to develop and produce on their own suitable high-performance aircraft, and cruise-type or ballistic missiles. Even the more advanced countries now lacking modern delivery systems would probably require 4–6 years to develop and produce limited numbers of modern bombers or shorter range surface-to-surface missiles (200–500 n.m.), and probably closer to 10 years to develop IRBMs. Moreover, the longer the development of delivery capabilities is postponed—either through lack of decision or capability—the greater the chances that the defensive capabilities of potential enemies would also increase, thus increasing the sophistication needed in the delivery system.

II. PROBABLE PROGRAMS

A. General Considerations

14. While the above review indicates the overall capabilities of various countries believed capable of developing an operational nuclear capability, it does not answer the question whether they will actually do so. Decisions to go ahead on such a program, or to carry out such a program once launched, will depend upon a complex of considerations both domestic and international. These include in the case of any specific country the nature of its political relations with other states, its estimated military requirements, and general psychological and emotional factors such as the intensity of the desire to increase national prestige, the domestic opposition to the acquisition of nuclear weapons, etc. The economic burden of such a program would in all cases be a major factor to be considered since even a program for a few crude weapons and an unsophisticated delivery system would cost several hundred million dollars. A more ambitious program, involving modern aircraft or missiles with compatible warheads, would require expenditures of up to several billions of dollars. (See Annex A for more details on the costs of various types of weapons and delivery systems.)

15. The weight of the factors mentioned above is not fixed and may change as costs and difficulties change and the political-strategic factors alter. The prospect of an agreement among the major powers for a nuclear test ban, for example, especially if it were viewed as a forerunner to broader disarmament steps, would undoubtedly strengthen forces opposed to the spread of nuclear capabilities. Growing pessimism as to the likelihood of any realistic disarmament agreement could in some cases (e.g., Sweden, India) tend to undermine opposition to the acquisition of a national nuclear capability.

16. Despite these uncertainties, we believe it possible to suggest which considerations will probably have most weight in particular countries, and to indicate their likely course for the next several years at least. Most countries considered in this paper are unlikely to be able to develop an operational nuclear capability in the period of this estimate, unless a decision is made shortly.

B. Unlikely Candidates

17. We believe it unlikely that Belgium, the Netherlands, Norway, Switzerland, Australia, Italy, and Canada will initiate independent nuclear weapons programs in the next few years. For the smaller countries in this group the costs of even a minimum program suitable to their geographic location would be burdensome, even if spread over 8–10 years, and would require substantial increases in present budgets. Such increases would probably necessitate simultaneous cut-backs in high priority economic and other military programs. Even Canada and Italy, despite their considerably greater potential, would feel the economic squeeze of such programs.

18. Moreover, these countries probably do not exclude the possibility that a nuclear capability—if deemed necessary for their defense—may be obtained in time more cheaply and easily from a major ally or friendly power. In most of these countries, moreover, and particularly in Norway and Canada, there is a strong and persistent domestic opposition to the creation of a nuclear capability and to the spread of nuclear weapons. However, at the same time many of these countries will probably continue to improve their overall capabilities in the nuclear field and develop their present peaceful programs with one eye cocked to the future possibility that they may eventually decide to develop an operational nuclear capability independently, or, if political circumstances should be favorable, together with other more advanced powers.

C. Likely Candidates and Special Cases

19. Special considerations apply to the remaining countries or groupings with capabilities to develop independent operational nuclear capabilities. France have already made the decision to develop such a capability. Other countries—Sweden, India, Japan, and West Germany—have almost certainly not made a decision to develop an independent capability. They have, however, the overall potential and have nuclear and missile activities underway which would facilitate the carrying out of a program to develop an independent operational nuclear capability. Finally, with the continuing trend toward European cooperation and integration in various fields European cooperation in the nuclear military field remains a possibility.

France [2]

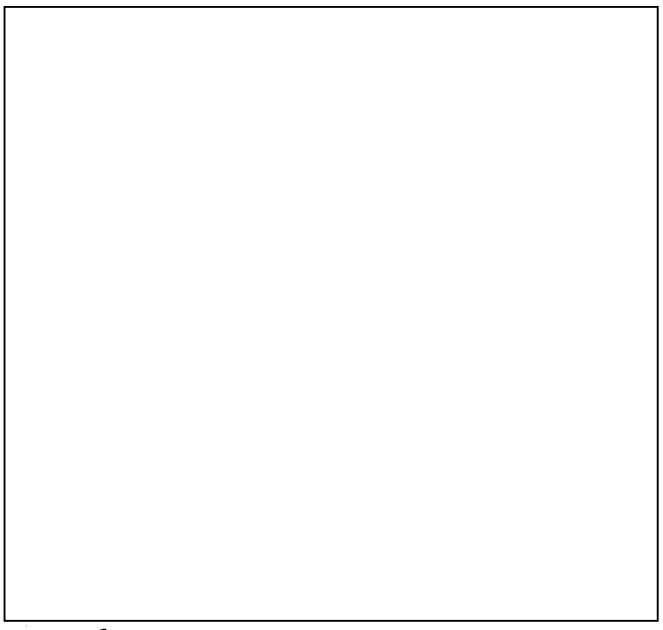
20. Nevertheless, France is continuing to press ahead with the development of an operational nuclear capability. Present plutonium production capacity is sufficient for 15–30 fission weapons a year, depending upon the yield, and will probably increase in 1963. In addition, the French have a gaseous diffusion plant under construction which could make weapon grade U–235 available by 1963–1964. The French program aims first at a bomber delivery system, to be followed by a missile system with a range of 1,500–2,000 n.m. it will probably have an initial operational nuclear capability in 1962–1963 using land-based aircraft, including a few MIRAGE IVs, a supersonic jet light bomber. de Gaulle intends that by the end of the decade France will have a varied nuclear strike capability using aircraft, IRBMs with either high-yield fission or thermonuclear warheads, and possibly nuclear-powered missile submarines.

21. So long as de Gaulle remains in power we see little likelihood of any slackening in French determination to carry through the program. While de Gaulle would probably welcome some external assistance, provided it was made available without military or political conditions, we believe that France is capable of carrying through its present programs without outside help. A successor regime, would probably be unable or unwilling to carry on the program as vigorously as

[2] See SNIE 22-61, "French Nuclear Weapons and Delivery Capabilities," dated 11 May 1961, SECRET, for further detail.

de Gaulle. As time goes by, however, it will become increasingly unlikely that any successor government, except a radical left government, would wish to abandon the effort.

22. French progress is heavily dependent on continued testing of both nuclear and missile components. Loss of testing sites in the Sahara would create major problems for the French program, the resolution of which would be costly and time consuming. Such a development could lead to basic modification in the French program—particularly after de Gaulle leaves—and could possibly result in greater reliance on multilateral arrangements within NATO.



Sweden

29. Sweden has so far avoided making any clear-cut decision in regard to a nuclear weapons program. Military leaders and some conservative political elements, as well as a few leaders of the governing Social Democratic Party (SDP) have agreed that an operational nuclear capability would discourage Soviet attack on Sweden, alone or in connection with hostilities between Soviet and NATO forces. Moreover, basic nuclear research of high quality is continuing, and there are some indications that a facility for plutonium separation is in the planning stage. However, the economic and financial costs, the strong opposition within the bulk of the SDP, and the fact that it will probably be at least several years before enough domestically produced plutonium becomes available even to conduct a test, have all combined to keep a clear-cut decision in abeyance.

30. The present government is likely to remain in power for several years more at least, and it has taken the position that no decision will be made before 1963 on the question of whether or not to direct its nuclear program toward the production of weapons. If at that time the international climate appeared to be calm, especially if positive steps toward disarmament had been agreed upon by the major powers—or there were reasonable hopes that one would materialize—it is unlikely that the Swedes would decide to undertake a nuclear weapons program. In the absence of such reassuring factors and especially if other countries had already decided to produce nuclear weapons, the pressure to initiate a nuclear weapons program would probably grow sharply. In the event of a rapid degeneration of the international situation, the Swedes might prior to 1963 make a decision to have a weapons program. However, even on a crash basis we believe they could not have enough domestically produced weapon grade material to conduct a test before 1964–1965.

31. Sweden's basic aim in developing an operational nuclear capability would be to command respect for its traditional policy of neutrality. Sweden recognizes, however, that its only potential enemy is the USSR and hence their delivery systems would be primarily for defensive, relatively short-range weapons. Given this aim, the considerable costs involved, and its geographic proximity to Soviet targets, Sweden would probably plan a limited program involving development and production of high-performance jet aircraft and shorter range (200–500 n.m.) missiles with compatible fission warheads. Provided a decision were made to go ahead in 1963, and given Sweden's advanced nuclear research program, its nuclear power program and its industrial resources, we believe it could produce enough weapon grade plutonium to enable it to start testing about 1965–1966, to have a weapon deliverable by aircraft a year or so afterwards, and missile systems carrying compatible fission warheads by 1970.

India

32. The psychological and political factors opposing any nuclear weapons program continue to be strong in India. The cost and reluctance to divert resources from present economic programs also constitute significant barriers. On the other hand, there is clearly a mounting Indian concern with Communist China's foreign policy, and a growing awareness that probable Communist Chinese progress in the nuclear weapons field endangers

India's security, prestige, and ability to maintain a neutral posture.

33. There are indications that India is deliberately improving its overall capabilities in the nuclear field, possibly in anticipation that a future decision to develop an operational nuclear capability may be required. India has three nuclear reactors in operation, one of which—a 40 MW type constructed with Canadian assistance—is capable of producing quantities of plutonium sufficient for about one or two weapons a year. While India has agreed to some restrictions regarding the use of this reactor and the disposition of its fuel, India has indicated its desire to avoid such limitations and is pressing ahead with development of uranium sources which would make it independent of such limitations. A plutonium separation plant is also being designed and preliminary construction has been started with a completion date set for 1963, although it is unlikely that it will be in operation before 1964–1965.

34. The explosion of a nuclear device by Communist China would greatly strengthen the view in India, particularly in conservative and military circles, that there is a pressing need for an Indian nuclear capability if India is to avoid either bending to Communist Chinese pressure or being forced into a position of outright dependence on Western external support. Even so, we believe India would not decide to devote its nuclear facilities to a weapons program unless its leaders were firmly convinced that no broad disarmament agreements were possible, or that Communist Chinese foreign policy was clearly growing more truculent. Such a decision would probably be more likely if, at the time, Nehru had left the political scene and had been succeeded by a right-wing Congress Party Government. If such a program were launched, the antinuclear voices would continue strong, and if the program appeared to encounter significant snags or involve excessive costs, the program might be cut back, if not actually abandoned.

35. In view of the considerable economic costs, and India's limited technological capabilities in the missile field, any independent Indian effort would be likely to concentrate on the creation of a modest stockpile of plutonium weapons and an aircraft delivery capability. Provided such a decision were made in the next year or two, India could have such a capability sometime around 1967–1968. While India now has the British Canberra bomber with a capability to deliver a bombload of 6,000 pounds to a distance of about 1,400 n.m., the Canberra could not carry internally a bomb with a large diameter and it would take India several more years to develop its own nuclear weapon compatible with the Canberra. However, India would probably expect to be able to procure foreign aircraft with improved nuclear carrying capabilities.

Japan

36. Given the state of Japan's scientific and technical advancement and its industrial resources, we believe that Japan could probably have its first nuclear device in five or six years, if it decided in the next year or so to embark on a nuclear weapons program, and that it could have its first weapon deliverable by aircraft a year or so later. It could also probably develop missiles with ranges up to 1,000 n.m. in about the same time and compatible fission warheads for such missiles by 1970.

37. It is highly unlikely, however, that Japan at this time has any serious intentions of undertaking a nuclear weapons program of its own. Antimilitary, particularly antinuclear, attitudes remain extremely strong among the populace and susceptible to exploitation by socialists and Communists. The diversion of resources from development and welfare programs would not be politically feasible. There is, moreover, considerable support for continued reliance on US military support, and doubts in the minds of many that a nuclear capability would promote Japanese security, given Japan's highly concentrated population and exposed geographical position.

38. These attitudes and views could change in the coming years with changing circumstances, e.g., if it became increasingly clear that progress on international disarmament was unlikely, if Communist China detonated a nuclear device, if other countries, notably India, decided to develop nuclear weapons, or

if confidence in the US alliance decreased. In such cases, pressures for an independent capability would probably increase. Nevertheless, barring the unlikely return to power of a right-wing authoritarian government, we believe that Japan will not undertake a nuclear weapons program of its own in the next few years.

West Germany

39. We do not believe that the West Germans now have any definite plans for developing an independent nuclear capability. The foreign and military policy of West Germany continues to rest on the principle that the country's security against the Soviet Bloc depends on a strong and cohesive NATO in which US power and leadership play the central role. Moreover, the obstacles to initiating such a program are considerable. Treaty restrictions and lack of space for testing constitute hurdles to an independent effort. Furthermore, to undertake a nuclear weapons program in the near future would probably involve serious political dissension both within West Germany, and in the Western Alliance, and act as a provocation to the USSR at a time when the overall West German military strength is still limited.

40. On the other hand, West German interest in improving the strength of West Germany's military forces by acquiring modern weapons, and sensitivity to any indications that West Germany has a second-class military status in the Western Alliance, continue to increase. Moreover, as West Germany continues to grow in strength and importance, such feelings are likely to mount, especially if following Adenauer's departure present Defense Minister Strauss moves into greater political prominence.

41. Since 1957 West Germany has been carrying on a nuclear power and research program as well as research in missiles. Of particular interest is the work which the West Germans have done on isotope separation including the gas centrifuge process. If this latter process bears fruit, the separation of U–235 from uranium ore would be greatly facilitated. West German participation in a joint European space program will also give West Germany a boost in the missile field and help remove what gaps may still exist between itself and other major European countries on this score.

42. We believe that West Germany could detonate a nuclear device in four to five years if it made a decision to have a crude weapon suitable for delivery by large aircraft and could also develop in that period missiles with ranges up to 1,000 n.m. Weapons suitable for missile warheads, or for delivery by such advanced aircraft as the F–104, would probably take several additional years to develop and would require considerable testing.

43. Whether or not West Germany makes such a decision will depend less upon its technical capabilities than upon broader political developments, and the degree of prosperity and security which it derives from its Western Alliances. For the present we believe West Germany will continue to seek the benefits of nuclear capability through cooperation with its allies. Initially, and so long as NATO strategic doctrine remains responsive to what the West Germans believe to be their security needs, they will seek NATO solutions including a multilateral nuclear capability under arrangements which would give the West Germans as much voice as other NATO countries in the use, if not the direct control, of nuclear warheads. If frustrated on these matters, West Germans might look to some form of European cooperative effort to produce an operational nuclear capability. Failing all these, the West Germans might be then tempted to initiate an independent nuclear program, or even to consider some political accommodation with the Bloc. Such a situation, however, is unlikely to develop unless there are fundamental alterations in the concept and nature of the NATO Alliance which are seemingly in conflict with what the West Germans believe to be their basic security needs.

Western European Groupings

44. Extensive cooperation between France and West Germany, especially within the framework of a larger continental European

arrangement, would reduce both the time and economic burden involved in developing independent nuclear capabilities. Moreover, such cooperation would remove or mitigate substantially the major political, legal, and technical obstacles to an independent West German effort. European cooperative action on many levels, especially within the Common Market grouping but also extending outside this group in matters of defense production, and probably space activities, tends to improve the climate for cooperation in this field. Nevertheless, we believe it unlikely that any significant cooperation in the nuclear field between continental European countries will develop during the next several years.

ANNEX A

ESTIMATED COSTS OF DEVELOPING AN OPERATIONAL NUCLEAR CAPABILITY

I. GENERAL

1. The cost of attaining any given level of an operational nuclear capability in any given country is subject to so many variables that it cannot be estimated with any real precision. However, it is possible to estimate a rough order of magnitude of expenditure which a prudent planner at the present state of the art would probably have to be prepared to fund, assuming reasonable success in research, development, and production. We estimate that over the next several years there will be no technological breakthrough which would significantly alter the complexity and costs of this task.

2. As indicated below, the initiation fee for the nuclear club would probably vary considerably depending upon the class of membership sought. A minimum program, i.e., explosion of a device, production of a few crude weapons and the acquisition of aircraft able to deliver the weapons, could be pursued with a total expenditure of roughly $200 million. A much more ambitious program, such as that of the French would probably involve expenditures of at least several billions of dollars.

II. HYPOTHETICAL MINIMUM PROGRAM

A. Nuclear Weapons

3. A minimum capability, e.g., 1–2 low-yield all-plutonium fission weapons a year to be delivered by aircraft (e.g., bombers or modified commercial aircraft) could be obtained in as little as six years with an initial investment of some $150–$175 million. The breakdown of costs for such a program would be roughly as follows: $50 million for research and test facilities; $50 million for the operation of research and test establishments; and $50–$75 million for the acquisition of materials and the construction of the plutonium production and separation facilities. Additional outlays of $8–$12 million would be required for each of the 1–2 weapons which could be produced annually.

B. Delivery Vehicles

4. The actual costs involved in developing or modifying available aircraft would depend upon the sophistication of the delivery system desired. However, if the requirement were only to obtain from others an aircraft big enough to accommodate a crude weapon, the costs would be small. The cost of developing such an aircraft from scratch would, of course, be large.

III. A MODERATE PROGRAM: THE FRENCH EXAMPLE

A. Nuclear Weapons and Warheads

5. According to official French figures, France spent in the period 1946–1960 the rough equivalent of $1.1 billion on its whole nuclear program, including peaceful uses. We estimate that of this sum about $900 million has been allocated to such initial investments as research and development test facilities, uranium mines and processing equipment, the construction of reactors and separation plants; the remainder has been used for operating the uranium mines, ore processing facilities, reactors and the chemical separation plants asso-

ciated with plutonium production. From this program, France has acquired a plutonium production capability sufficient for 15–30 weapons a year, the beginnings of separation facilities for U–235, and the ability to produce plutonium weapons at a cost of $1–$3 million each. At the same time, France has advanced a significant step toward the level of capability necessary to produce a wide variety of weapons, including thermonuclear types.

6. Provided the French continue to press ahead with a program intended to give them a considerable quantity and variety of weapons sizes and yields, the annual costs will undoubtedly continue to rise substantially over the next decade, especially if testing is pursued under restricted conditions.

B. Delivery Capabilities

7. The French effort in the delivery field has been focused on the MIRAGE IV light jet bomber which is now in production. By 1964–1965 France will probably have 50 such bombers operational at a cost of somewhere between $200 and $250 million. In the meantime, however, the main focus of French effort in the delivery field will shift to missiles. The actual outlays for missiles will obviously depend upon the types, sophistication, and numbers sought. Given the indicated French interest in developing a short-range missile, an IRBM, and a "Polaris" type system, the combined costs of such programs could run into the billions of dollars. For example, assuming the intent to have a limited number of operational missiles in each class, and using US programs as rough analogues, the cost for a 300–500 n.m. missile could be about $200 million for an IRMB, about $700 million. A "Polaris" system, comprising several nuclear-powered submarines and underwater launched missiles, could cost between $2.5–$3.5 billion.